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# Adhesion Test Methods

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## Technical Data Sheet

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### General

ALT systems may be applied on a variety of substrates including but not limited to concrete, wood, metals, plastics, insulations, specialty roof board underlay, existing single-ply membranes, built-up roofing, and coatings. ALT Systems, as with other liquid applied membranes and coatings, require a sound stable substrate to insure proper application, adhesion and performance. The application substrate must be clean, dry, free of loose, spalled or weak material, oil, grease, contaminants, abrupt changes in level, waterproofing agents, curing compounds, and free of projections which could damage the membrane.

Before applying ALT products, the substrate must be evaluated to determine:

- suitability of the top surface to receive the ALT system
- required surface preparation for proper adhesion of the ALT system

In addition to the above, when an existing single-ply membrane, built-up roof, or coating is to be recovered, a determination as to the adequacy of adhesion or attachment of the existing waterproofing to the substrate is required. Once the substrate is evaluated and deemed suitable, the ALT system application may proceed.

### Recovering Existing Membranes & Coatings

ALT systems may be applied over acceptable existing single-ply membranes, built-up roofing, and coatings as recovery applications. When recovering an existing membrane or coating, adhesion of the ALT system will be limited by the integrity and adhesion of the existing membrane or coating to the structural substrate. Therefore, in recovery applications the ALT warranty is limited to adhesion of the ALT system to the surface of the base membrane or coating.

At minimum the existing membrane or coating should be intact and bonded to the substrate with adequate adhesion to resist the design uplift pressures and/or dynamic loads required by the model building code for the structure, building components, cladding and new waterproofing system.

### Recommended Guidelines

ALT recommends the prepared substrate provide membrane adhesion with minimum bond strength of 116 psi (0.8 N/mm<sup>2</sup>) for roofing applications or 219 psi (1.5 N/mm<sup>2</sup>) on concrete for traffic bearing applications. For roofing and waterproofing applications the minimum bond strength will vary depending upon the substrate type and material used. At minimum ALT roofing and waterproofing systems should resist the design uplift pressures and/or dynamic loading required by the model building code for the structure and new waterproofing system.

Determinations of bond strength should be performed by the contractor prior to the ALT application and periodically throughout the course of work at intervals as required assuring the specified adhesion. At minimum three (3) tests per 5000 ft<sup>2</sup> (464.5 m<sup>2</sup>) should be performed. For all ALT systems, adequate adhesion normally results in resin transfer (a residual layer of bonded resin) onto the substrate. In the event the tensile bond strengths are lower than the recommended minimum, additional substrate preparation is required.

Once the necessary preparations are complete, a suitable ALT primer is applied where required, followed by application of the ALT membrane. Please refer to ALT Technical Data Sheets titled "ALT Substrate Preparation, Leveling, Patching & Repair" and "ALT Priming Guidelines" for additional recommendations, requirements and methods for substrate preparation.

### Field Adhesion Testing Methods

A variety of recognized methods can be used to determine bond strength to a substrate. Commonly used field techniques include a knife test, peel strips or portable pull-off adhesion tester. Any one of the above test methods will allow evaluation of the surface bond strength and should determine if adhesive (failure at the coating/substrate interface) or cohesive (interstitial failure within the membrane, coating or the substrate) occurs.

### Portable Adhesion Tester

The portable adhesion tester may be used to test adhesion for all traffic and non-traffic bearing ALT roofing, waterproofing and surfacing systems. A standard test method for application and performance of a pull test using the portable adhesion tester is available in ASTM D4541, ISO 4624, and BS EN 24624. A portable adhesion tester will provide the most reliable and quantitative results for all adhesion testing. This test method shows resistance to tensile stress, while other methods such as the knife or peel strip adhesion tests demonstrate resistance to shear stress.



### Portable Hydraulic Adhesion Tester 1

With a portable adhesion tester a loading fixture, commonly called a dolly or stub, is affixed by an adhesive to the membrane or coating surface. A uniform load is increasingly applied to the test surface using the portable pull-off adhesion tester until the dolly is pulled off. The force required to pull off the dolly or the force the dolly withstood, yields the tensile strength in pounds per square inch (psi) or mega Pascals (MPa). Failure (the fracture surface) will routinely occur along the weakest plane within the system comprised of the dolly, adhesive, coating system, or substrate.

Most testers operate using either mechanical (twist by hand), hydraulic (oil) or pneumatic (air) pressure. Pull testers are classified as being fixed aligned or self aligning depending upon their ability to ensure a vertical pull-off force. The best repeatability is obtained with self aligning pull testers that ensure the pull-off force acts perpendicular to the surface being tested.

### Peel Test

The Peel Test may only be used for non-traffic bearing roofing and waterproofing, and is performed using fabric strips applied in the liquid applied roofing, waterproofing or coating material. It establishes whether the adhesion of a coating to a substrate or to another coating (in multi-coat systems) is at a generally adequate level. Performance is based on

both the degree of difficulty to remove the coating from the substrate and the size of removed coating.

Normally, one to two inch wide fabric strips are applied to the substrate embedded in the coating or liquid applied membrane material. After the coating or liquid applied membrane is allowed to cure, attempt to peel the coating or liquid membrane from the substrate or from the coating below.

For ALT systems, adequate adhesion normally results in a resin transfer (a residual layer of bonded resin) onto the substrate. A standard method for the application and performance of this test is available in ASTM D6677.

### Knife Test

The knife test may only be used for non-traffic bearing roofing and waterproofing to check the adhesion of an in place membrane. A utility knife is used to pick at the coating, and establishes whether the adhesion of a coating to a substrate or to another coating (in multi-coat systems) is at a generally adequate level.

Using the knife and cutting guide, two cuts are made into the coating with a 30 – 45 degree angle between legs and down to the substrate which intersects to form an “X”. At the vertex, the point of the knife is used to attempt to lift up the coating from the substrate or from the coating below.

For ALT systems, adequate adhesion normally results in a resin transfer (a residual layer of bonded resin) onto the substrate. A standard method for the application and performance of this test is available in ASTM D6677.

### Other Tests

There are other laboratory adhesion tests that may also be performed. Some of these involve the use of tensile test machines with a textile strip embedded in the coating applied to the substrate (the tensile machine pulls substrate and cloth) or have the coating applied between two sheets of the substrate (tensile machine pulls on both substrate pieces). ASTM D2370 describes one such test of elongation, tensile strength, and stiffness of organic films when tested as free films. Organic coating adhesion to plastic substrates by mounting an aluminum stud and removing it with a tensile tester is covered in ASTM D5179.

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